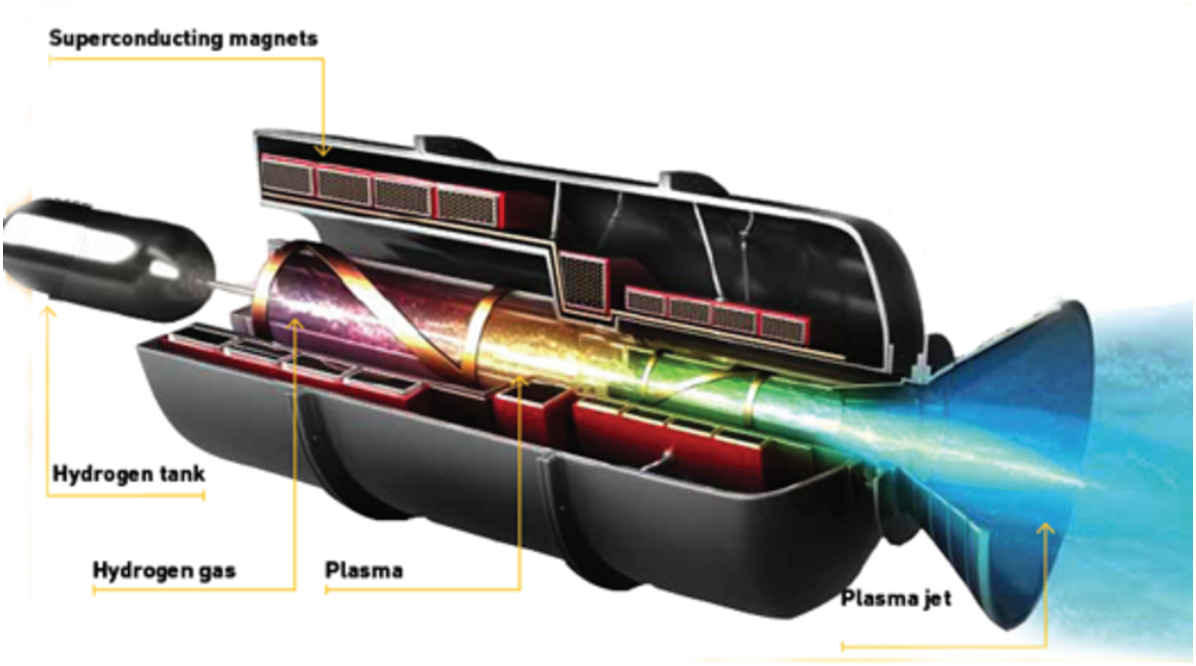
in the 1920s a young man named Frank Whittle was coming up with drawings for a theoretical engine very different from the propeller-driven kind, one that might scoop in air through turbines and fire it through a series of "jet" nozzles. "Very interesting, Whittle, my boy," said one of his professors of aeronautical engineering at the University of Cambridge. "But it will never work."



Artistic Rendering of the Vasimr Engine
The Vasimr rocket uses an enduring electrical source, such as a nuclear reactor or a solar generator, to transform hydrogen gas into plasma. Powerful magnets force the plasma out of the engine to propel the rocket at 123,000 mph.

The Challenge
Chang Díaz's invention will do little to reduce the dangers of liftoff. Plasma engines depend on the vacuum of space and still require "venerable chemical rockets," as Chang Díaz calls them, to reach Earth orbit. But outer space is where his work stands to vastly improve the safety of a crew. As he points out, a lot can go wrong en route to another planet. The limitation of space travel with a conventional rocket is that the rocket must use its entire fuel supply at once in a single, controlled explosion to reach Earth orbit. It then coasts along at a mostly uniform speed until it enters Mars's gravity. NASA estimates that such a trip would take about seven months. During that time, Chang Díaz explains, there is no abort procedure. The ship cannot change course. If an accident occurs, Earth would be watching, in a 10-minute communications delay, the slow death of the crew. "Chemical rockets are not going to get us to Mars," he says flatly. "It's just too long a trip." A plasma rocket like Vasimr, on the other hand, sustains propulsion over the entire journey. It accelerates gradually, reaching a maximum speed of 34 miles per second over 23 days. That's at least four times as fast as any chemical rocket could travel, shaving at least six months off a trip to Mars and minimize the risk of mechanical dangers, exposure to solar radiation (Chang Díaz's design shields the crew behind hydrogen tanks), bone loss, muscle atrophy or any of a thousand other liabilities along the way. And because propulsion is available throughout the trip, the ship could change course at any time.
But human spaceflight programs are currently built around old-fashioned rocketry. NASA has invested mostly in propulsion systems powered by chemical fuel, and for sensible reasons. Chang Díaz's rocket presents many challenges. For one thing, a Vasimr-powered Mars craft would need several nuclear reactors on board to generate the large amount of electricity required to heat the plasma. "The reality is, rockets don't always work," says Elon Musk, For Musk, who struggled for years to get his Falcon 1 rocket into orbit, the stakes seem particularly high in the case of rockets carrying nuclear material. "If something goes wrong, you have radioactive debris falling to Earth—you have a disaster," he says but Chang Díaz disputes the notion that launching Vasimr would pose extra risks. The reactors would remain inactivate until the ship was out of the danger zone for spreading radiation back to Earth, he notes.